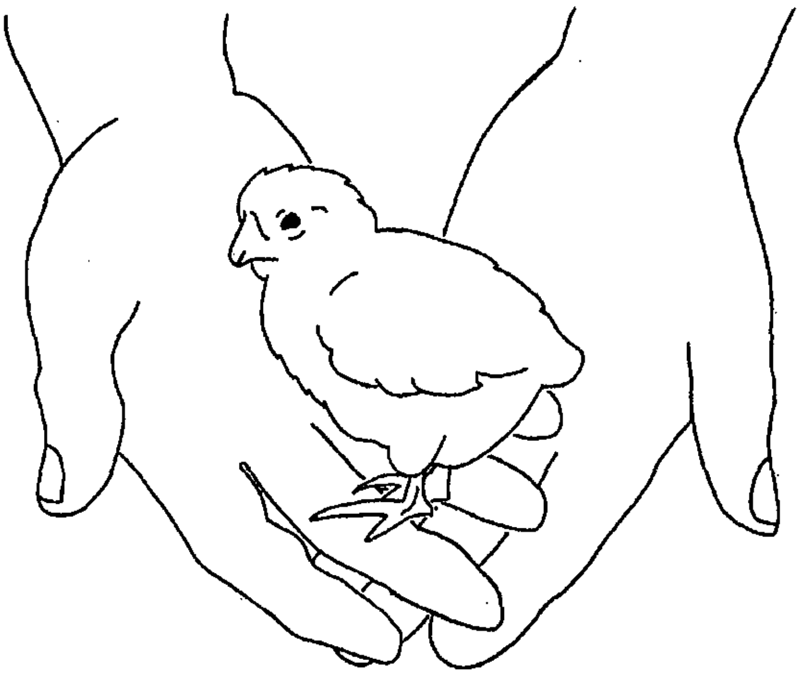
# EXHIBIT Q

# RECOMMENDATIONS FOR UEP ANIMAL WELFARE GUIDELINES



SUBMITTED BY
A SCIENTIFIC ADVISORY COMMITTEE ON
ANIMAL WELFARE

September, 2000



CONFIDENTIAL

# MISSION STATEMENT FROM SCIENTIFIC ADVISORY COMMITTEE ON ANIMAL WELFARE

Agriculture is changing at a pace faster than ever – a pace faster than many ever predicted. Because of many knowledge-based technological changes, United States citizens use less of their income for food than any nation on earth! Another consequence of this success has been that fewer and fewer people are directly involved in agriculture. Although the total economic impact of agriculture remains large, the percentage of citizens directly involved in agriculture has decreased to approximately 1.5% of the population. Consequently, consumers know less and less of where their food is derived, much less how it is grown. At the same time, however, consumers are demanding to know more and more about the impact of agriculture. In animal agriculture, this has been manifested in concerns of the impact of animals on the environment, food safety and animal welfare.

The United Egg Producers (UEP) was one of the first groups to establish welfare guidelines for an animal industry. However, UEP also recognized that the egg production industry could substantially improve the husbandry and living conditions of the laying hen. Recognizing the need to better understand the welfare of the hen, UEP commissioned a committee to provide recommendations for new welfare guidelines. I was pleased to serve as chair of this group and was asked to constitute the committee. UEP's charge was simple. They asked for a committee that could provide them with science-based welfare guidelines. UEP did provide one staff member and a producer as ex officio members of the committee. I was pleased that every member accepted our request to serve on the committee. You will find a list of the welfare advisory committee included within this document.

The following document contains the summary of the recommendations from the UEP Animal Welfare Committee. These recommendations are based on science. Extensive literature searches were conducted on every major topic. An extensive bibliography is available upon request. In every way possible, the committee's recommendations are based on available scientific research. The committee did not select any one system above another. The committee spent considerable time discussing the advantages and disadvantages of cage-based systems and supported the use of cages (with our recommendations). These recommendations are not meant to be all-inclusive. For example, guidelines are still needed in the areas of pullet rearing and non-cage based systems. UEP and its animal welfare committee will continue to evaluate these areas but the work herein mainly deals with cage systems. The committee believes it is important to publish our recommendations as soon as possible.

In closing, it is very important that the egg producer, consumer or casual reader understand that these guidelines are dynamic. In addition to deriving solid guidelines, the committee also recognized numerous areas where we simply do not have enough information. As a result, the committee has provided an extensive list of research and education recommendations. The committee's, as well as UEP's goal is that egg production be socially, economically and environmentally sustainable. We believe these guidelines set the direction for achieving these goals.

*Jeffrey D. Armstrong, Chair*

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# PUBLIC PERCEPTIONS AND ATTITUDES

*Background*

Poultry production practices have generated public discussion about the well-being of laying hens raised in intensive production systems. Concerns about the welfare of farm animals have arisen in developed nations because of public interest in, and expectations regarding, the use and treatment of animals. Other concerns, like food safety, arise from the idea that stressed animals are more susceptible to illness and that this may ultimately compromise the safety of the product.

*Literature Review*

The intensity of interest in animal welfare shown in Western society may be attributed to a number of factors such as culture, economics, religious and philosophical beliefs, scientific knowledge, and aesthetic appreciation of animals and nature (Burghardt and Herzog, 1989). A basic understanding of how welfare concerns are manifested in our society is important when charting courses for future poultry production practices and responses to consumer concerns.

Surveys and polls show that consumers have clearly indicated that they retain confidence in farmers and ranchers to make responsible decisions concerning the welfare of their animals. They also show that consumers regard the humane treatment of farm animals as important and that their ethical perspectives on animal treatment are continuing to evolve

*Committee Conclusions*

Measuring factors like public egg consumption patterns, consumer opinion, effectiveness of public relations techniques, etc., can only offer assistance in addressing specific concerns about the welfare of egg laying hens. Long-term solutions to welfare problems will require not only an understanding of societal perceptions and expectations with regard to animal treatment, quality control and production, but also the scientific development and measurement of indices of hen well-being. Therefore guidelines for the care of egg laying hens will need to be dynamic and oriented to performance standards.

Maintaining the present level of consumer confidence is critical to the egg production industry. Therefore it is the responsibility of industry to make carefully researched and considered decisions regarding hen welfare. Producers who adopt sound guidelines for the welfare of their hens and incorporate these into their production operations will have a solid base from which to reassure the public that they are practicing good management and care for their birds.

*Recommendations*

1. The UEP should regularly review and revise their Guidelines for hen welfare to take into account current scientific knowledge about hen welfare.

2 The recommendations in the UEP Guidelines should be designed to foster high standards of hen welfare while still maintaining the economic vitality of the industry.

3. The UEP should promote scientific research on methods to evaluate and improve hen well-being.

# BEAK TRIMMING LAYING STRAINS OF CHICKENS

### *Background*

Egg laying strains of chickens are beak trimmed to reduce injuries and deaths due to feather pecking and cannibalism. Outbreaks of feather pecking and cannibalism can occur among hens in any type of housing system, and represent a serious welfare and production problem.

An additional reason producers beak trim is to improve feed efficiency. Feed wastage, feed intake, and body weight are reduced in beak trimmed birds with no long-term effect on hen productivity and egg traits (Craig et al., 1992; Cunningham, 1992).

### *Literature Review*

Bird behavior, production, physiological measurements of stress, and pain as indicated by neural transmission in, and anatomy of, the trimmed beak have been used as criteria to determine if beak trimming compromises bird well-being. In addition, the welfare of those hens who are pecked by beak-intact hens has been evaluated. The welfare of a flock is assessed by mortality, incidence of cannibalism, feathering, and flock behavior such as fearfulness or nervousness (Gentle, 1986a; Cunningham, 1992; Hughes and Gentle, 1995). Beak trimming has both disadvantages and advantages as far as welfare is concerned. Disadvantages include short-term and perhaps long-term pain, and short-term stress following beak trimming. The bird's ability to feed herself following beak trimming is impaired; the bird must adapt her feeding behavior to the new beak form. Welfare advantages include reduced pecking, feather pulling, and cannibalism; better feather condition, less fearfulness and nervousness, less chronic stress, and decreased mortality. It appears that the welfare disadvantages are applicable to individual birds whose beaks are trimmed, while the welfare advantages are more applicable to the interactive flock.

Evidence suggests that primary breeders of egg laying strains can select for a more docile bird and minimize the need to beak trim from a behavioral point of view (Craig and Muir, 1993).

### *Conclusions of the Committee*

After weighing the evidence about the welfare advantages and disadvantages of beak trimming, the committee concluded that the welfare advantages currently generally outweigh the disadvantages. Using genetic stocks that require little or no beak trimming is the most desirable approach. However, under certain management systems (e.g., exposure to high intensity natural lighting) and with some genetic stocks, beak trimming is recommended to prevent feather pecking and cannibalism. Therapeutic beak trimming is recommended at any age if an outbreak of cannibalism occurs in a non-trimmed flock. Comb, claw, toe and spur trims are not recommended.

A first trim should be conducted at 10 days of age or younger. **Production traits** (Bramhall and Little, 1966; 1968; Andrade and Carson, 1975, Lee and Reid, 1977, Lee, 1980), **behavior** (Eskeland, 1981, Duncan et al., 1989; Gentle et al., 1990; Lee and Craig, 1990; 1991, and Gentle et al., 1997), and **anatomical and neural evidence of acute and chronic pain** (Desserich et al., 1983, 1984; Gentle, 1986 a, b; Dubbeldam et al., 1995; Lunam et al., 1996; Gentle et al., 1997) were used as criteria to assess the optimum age for a single trim program.

If the trimmed beak grows back, a second trim may be needed. A second trimming is more permanent in that the beak does not grow back as easily. Some strains of egg layers, especially under conditions of high

light intensity, may need to be subjected to a second trim when the pullets are 5 to 8 weeks of age. To avoid a drop in egg production, a second trim is not recommended after 8 weeks of age (Andrade and Carson, 1975; Carey and Asher, 1992).

## Beak Trimming Recommendations for UEP Guidelines

1. Where possible, producers should select genetic stocks known to require little or no beak trimming.

2. Crews responsible for beak trimming should be trained and monitored for quality control.

3. The recommended procedures for a Single-Trim Program are:

   a. The beaks of chicks should be trimmed when the chicks are 10 days of age or younger.

   b. Approximately 2 days before and 2 to 3 days after beak trimming, consideration should be given to adding vitamin K (5 mg/liter or 20 mg/gallon) and sometimes Vitamin C (20 mg/L or 80 mg/gal) to the water to facilitate clotting, to alleviate stress, and reduce dehydration.

   c. The levels of feed and water should be increased until beaks are healed.

   d. If drip nipples or trigger activated waterers are used, recently beak trimmed chicks will have difficulty activating the trigger devices (Bramhall, 1962); therefore, consideration should be given to lowering water pressure for several days following trimming. Cup waterers may have to be manually triggered for a few days following trimming.

   e. To minimize weight loss, consideration should be given to feeding birds a prestarter, starter or high density stress diet for about 1 week following beak trimming

   f. A precision automated cam activated beak trimmer with a heated blade (e.g., 1200 degrees F) should be used to trim the beaks of chicks 10 days of age or younger. The beak should be both cut and cauterized. The beak trimmer has a guide, usually with three separate holes arranged horizontally, for the insertion of the bird's beak. The diameters of the holes are usually 9/64, 10/64, and 11/64 inches. The purpose of the three different hole sizes is to allow the operator to tailor the selection of the hole size to the individual bird whose beak is being trimmed. Beaks not only vary in size within a given hatch, but over the several days that are required to trim larger flocks. The chick's closed beak should be inserted into a selected guide hole when the blade is at the top of the cycle. The thumb should be placed against the back of the chick's head and the forefinger should be placed under the throat to bring the chick's tongue back out of the way of the blade to prevent burning the tongue. The blade should then be dropped down to make the cut. The heated blade should be in contact with the beak for about 2 to 3 seconds to cauterize the blood vessels to prevent hemorrhaging. The chick's beak should not be removed from the heated blade until the full cauterization time is over (Bramhall, 1976). Both the upper and lower beaks should be trimmed. The length of the upper beak distal from the nostrils, which remains following trimming, should be 2 to 3 mm. The lower beak will be slightly longer than the upper beak due to the fact that the chick's head is tilted slightly downward when the closed beak is inserted into the guide hole.

g. The blade and the guide holes of the beak trimmer should be cleaned regularly with a wire brush. Since the guide holes shrink in size with use, the operator should ream the hole out using a 9/64, 10/64, and 11/64-inch drill bit after trimming several hundred chicks. Blades should be replaced with new ones after every 3,000 chicks. The trimming machine should be cleaned and disinfected after each use.

5. The recommended procedures for a Second-Trim Program are:

a. A manually operated heated blade of 1300 degrees F in which the upper and lower beaks are trimmed separately should be used. The operator's finger should be placed between the upper and lower beaks and each beak should be cauterized separately. The operator should use a rolling wrist action so that the corners of the beak are rounded thoroughly. Cauterization times for the upper and lower beaks should be 3.0 to 3.5 seconds and 2.0 to 2.5 seconds, respectively. The length of the upper beak distal from the nostrils that remains following trimming should be 4 to 6 mm, with the lower beak slightly longer than the upper beak.

b. If avoidable, birds should not be subjected to stressful conditions such as handling, moving, vaccination, etc., for two weeks following beak trimming.

# HOUSING, SPACE ALLOWANCES, AND ENVIRONMENT

### *Background*

As late as the 1940s, small backyard flocks of chickens made up the majority of the egg producing industry. Eggs were only produced seasonally because the hens entered a natural molt in the winter, and hens were consumed for meat after they had laid only a relatively small number of eggs. Mortality in backyard flocks could be high due to temperature extremes, predators, and soil-borne disease.

To meet a growing demand for eggs, farmers began upgrading, enlarging, and automating their production facilities. Gradually, producers adopted cage housing systems for their hens because of the advantages these systems provided for egg production and hen health. Today, 98% or more of the commercial egg production in the U.S., and an estimated 70-80% of the world's egg production, are derived from caged layers. The remaining hens used for commercial production are housed in floor pen or free-range systems. Most hens are now also kept in environmentally controlled facilities, and egg collection, watering, feeding, and manure collection are all automated.

Recently, consumer concerns have arisen about the use of conventional cages for laying hen production, and for this reason in Europe there is a movement away from cage housing to more extensive systems. The primary criticism of conventional cages is that they restrict the hen's freedom of movement and behavior, and particularly do not allow the hen to dustbathe, select a nesting site, or perch. High stocking densities in cages have also been criticized, and the literature review in this section of the document will focus primarily on that issue.

### *Literature Review*

Space allocations in cages are a very important element of bird welfare. There is a large body of evidence demonstrating that decreasing the space allowance per hen in cages is associated with increased mortality and decreased hen-housed production, both widely accepted as indications of reduced welfare. For example, Bell and Carey (1988) summarized the results of the 23rd - 27th North Carolina Random Sample tests conducted between 1982 and 1987, which involved comparisons of hens housed either in 3-bird groups given 72 squares inches per hen or 4-bird groups given 54 square inches per hen. Mortality was higher at the higher density (11.0 versus 8.1 % at the lower density), and hen housed egg production was lower (235 eggs versus 245 at low density).

Adams and Craig (1985) analyzed the results of 30 experimental and field research reports on housing space allocation and cage shape published between 1971 and 1983. Since densities were not identical in the different studies, ranges for comparison were established. Densities ranging from 67-86 $in^2$ per hen (average 80 $in^2$) were considered low, those ranging from 55-66 $in^2$ per hen (average 60 $in^2$) were considered medium, and those ranging from 42-55 $in^2$ per hen (average 48 $in^2$) were considered high. Mortality was 2.8% higher at high than medium densities, and 4.8% higher at medium than at low densities (i.e., there was 7.6% higher mortality at high than at low densities). Hens housed at high densities produced 16.6 fewer eggs (per hen housed) than hen housed at medium densities, and these hens in turn produced 7.8 fewer eggs than hens housed at low densities (i.e., a decrease in 24.4 eggs per hen housed at high as compared to low densities). Bell (1999) summarized research conducted over a thirty-year period by the University of California Cooperative Extension that arrived at similar conclusions. (Bell, undated)

states that "numerous studies have shown time and again that additional birds decrease hen-housed egg production and increase mortality. Our analysis of 45 experiments conducted across the US and Europe show 14 fewer eggs and 3.9% higher mortality rates for each addition of one bird per cage."

The research on space allowances can be summarized as follows:

- Numerous studies, primarily involving White Leghorn hens and conducted under U.S. conditions, have shown that decreasing space allowances in cages to below approximately 72 square inches per hen (with a range of about 67-86 square inches per hen) significantly reduces hen-housed egg production and increases mortality.
- Other measures of stress, including stress hormone (corticosterone) levels and nervousness, generally also support this recommendation, although these measures are more difficult to interpret.
- Providing more than 86 square inches of space has been associated with further significant increases in hen-housed production and decreases in mortality in some studies, but not in others. Hens actually avoid certain larger space allocations, and more aggression may occur when more space is provided.
- Measurements of White Leghorn hens show that they require about 65-83 square inches (average 74) to perform even the most basic behaviors (standing comfortably and resting). More room is required to perform other behaviors, like wing-flapping.
- Increasing density, increasing group size, and decreasing feeder space probably have separate and additive negative effects on welfare. Feeder space is a critical element affecting welfare. Due to competition among the hens, lower-ranking hens are unable to consume sufficient feed, or to consume feed at the time that they are most highly motivated to do so, if the feeder space is inadequate. Four inches of feeder space per hen is required for all hens to have free access to the feeder.

In contrast to work on space allocations in cages, there has been little research on the types or numbers of waterers needed for hens or pullets. Briefly, the research that has been done suggests that many different designs of waterers can be used successfully for hens and pullets, and that pullets can adapt well to a new type of waterer when they are moved into the cage house. However, they may need assistance in finding or operating the waterers for several days after being housed. The recommendations for the number of waterers/bird below are based on standard guidelines (Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching, 1999), but manufacturers guidelines should also be consulted.

*Committee Conclusions*

There are a variety of different systems for housing and managing laying hens. Each has welfare advantages and disadvantages, but with proper husbandry and selection of equipment many of these systems can provide an acceptable level of welfare for the hens.

Because most hens in the U.S. are housed in conventional cages, the committee considered space allowances in this system in great detail. There is overwhelming evidence that hen welfare in conventional cages is impaired when hens are given space allowances of less than 67-86 square inches (average about 72 square inches) per bird and also evidence that hen welfare is impaired when feeder space allowances are less than 4 inches per bird.

Modified cages (that is, cages that include perches, nestboxes, and/or dustbaths to provide opportunities for the birds to perform a variety of behaviors) are a promising development. Such cages could provide the hen with additional behavioral opportunities while still retaining the hen health benefits associated with cages

(Appleby, 1993; Tauson, 1998). However, research on these cages is still at a preliminary stage, and it is too early to tell whether or not they will improve overall hen welfare, be commercially feasible, and be acceptable to consumers.

In general, housing for chicks, pullets, and hens should be constructed and maintained to provide protection for the birds from environmental extremes and predators. The birds should be managed in a manner that minimizes transmission of disease, infection with parasites, and vermin infestation in accordance with accepted principles for disease prevention. House and cage design must facilitate optimal daily care and inspection of the birds. When cages are used, they must be designed and maintained so as to avoid injury to the birds. Cage, feeder, and waterer construction should take into account proven advantages for bird comfort, health, and welfare, and facilitate the safe removal of birds.

Recommendations for housing pullets and housing hens in floor and free-range systems are still under discussion by the Advisory Committee. Although the current recommendations contain some information for these production systems (for example watering space), detailed recommendations will be incorporated in a later revision of this document.

**Housing Recommendations for Caged Hens for the UEP Guidelines**

1. Cage configuration should be such that manure from birds in upper cage levels does not drop directly on birds in lower level cages.

2. Hens should be able to stand comfortably upright in their cage without having their heads protruding into the cage above. A cage height of 16-17 inches will generally be acceptable for small Leghorn strains, while larger strains will require taller cages. The slope of the cage floor should not exceed 8 degrees.

3. Space allowance should be in the range 67 to 86 square inches of usable space per bird, depending on the type of cage and the type of bird that is being housed. For example, space allowance can be at the low end of the range in shallow cages in which small Leghorn strains are housed, but should be at the higher end of the range in deep cages housing larger strains like brown hens. Usable space is space that it not obstructed by cage equipment, and that has a ceiling height that is high enough for the hens to s stand comfortably upright.

4. A minimum feeder space of 4 inches per bird should be allocated such that all birds can feed simultaneously.

5. Newly hatched birds may have difficulty obtaining water unless they can find waterers easily, and similar difficulties may occur when older birds are moved to strange surroundings, especially if the type of watering device differs from that used previously by the birds. Thus, assistance should be provided to the birds in locating waterers under these circumstances. Birds need to learn to use watering cups that require them to press a lever or other releasing mechanism. If birds are not familiar with these types of waterers when they are moved to the laying house, watering cups should be filled manually for a few days (or even a few weeks) until the birds learn how to operate them.

Chicks, pullets and hens should have continuous access to clean drinking water. However, water may be shut off temporarily in preparation for administration of vaccines or medication in the water. The manufacturer's guidelines for the number and placement of drinkers should be consulted, but general recommendations for watering space for birds are as follows:

| Age | Linear trough space/bird | Maximum number of birds per cup or nipple |
|---|---|---|
| 0-6 wk. | 0.6 in | 20 |
| 6-18 wk. | 0.8 in | 15 |
| older than 18 wk. | 1.0 in | 12 |

Perimeter space needed for round waterers can be determined by multiplying linear trough space by .8.

Water pressure must be regulated carefully with some automatic devices and watering cups. In such cases, pressure regulators and pressure meters should be located close to the level at which water is being delivered. Manufacturer recommendations should be used initially and adjusted if necessary to obtain optimal results. Automatic watering devices may require frequent inspection to avoid malfunctions.

6. Cages should be designed and maintained so as to avoid injury to the birds. When cages are replaced, cages with design features that minimize discomfort and injury to the birds should be chosen. Consideration should be given to floor space, floor materials (high quality galvanizing or plastic coating), the presence of an abrasive strip on the manure deflector to help decrease claw length, and cage door size and shape.

7. When mechanical systems such as mechanical feeders, egg collectors, or nests are installed, properly trained personnel should regularly check their operation and adjust and maintain them when necessary so that malfunction of the equipment or injury to the birds is avoided.

8. Poultry houses should be cleaned periodically to provide a healthy environment for the birds.

9. Poultry houses should be designed to provide a continuous flow of fresh air for every bird. Good ventilation, waste management, and husbandry practices usually result in acceptable air quality. Carbon monoxide levels in the air that the birds breathe in a house arising from unvented heaters should not exceed 150 parts per million, and methane levels should not exceed 50,000 ppm. The ammonia concentration to which the birds are exposed should ideally be less than 10 ppm and should not exceed 25 ppm, but temporary excesses should not adversely affect bird health. Comparable concentrations for hydrogen sulfide are 10 and 50 ppm, respectively. The concentration of dust in the house air should be minimized.

10. Lighting should be provided to allow effective inspection of all birds. Inspection of the birds should be conducted daily. Light intensity for egg production flocks should average .5 to 1 -foot candle for all birds at all feeding levels.

11. Birds should not be exposed to disturbing noises or visual stimuli or strong vibrations, whether originating inside or outside the house. Visitors should not be allowed without proper supervision both because they can cause layers to panic and injure themselves in their rush to escape and for reasons of biosecurity. Wild birds, pets, and other animals should likewise not be allowed in the poultry house.

12. Environmental conditions within the cage house should be such that hens can maintain their normal body temperature without difficulty.

13. Nutritionally adequate fresh feed must be easily accessible to all birds and care shall be taken at each change of the systems to insure that the birds find the feed.

14. Stand-by generators with alarm systems must be available in highly mechanized table egg laying and pullet growing houses. Such systems must be sufficient to supply emergency power for lighting, watering, ventilation, feeding, egg collection, and manure removal during a power loss.

# MOLTING

*Background*

For economic reasons, US egg producers typically do not sell hens after one production cycle. Instead, an induced molt is used to extend the life of the hen and to improve egg quality. The molt, which is accomplished by a period of feed withdrawal or restriction, rejuvenates the hen's reproductive system and provides an economic advantage to the producer (Bell and Weaver, in press; NCSU Review, 1999).

Induced molting is currently an integral part of the replacement programs used on table egg production farms in the United States. Not only individual farms, but the entire industry from breeders, to hatcheries, to the egg processing and marketing arms, is organized to take full advantage of the extended life of table egg layers.

Consumer concerns about agricultural production practices and the impact of these practices on the welfare of the animal have forced producers to reconsider the use of induced molting in laying strains of birds. The use of induced molting as a management tool has been partially justified by stating that molting is a "natural behavior" (Ruzler, 1998; Swanson and Bell, 1974). However, the hen in production today is a different bird than the ancestral hen that underwent a "natural molt".

*Literature Review*

**Natural Molting:** Molting is a normal process in chickens and other birds. It occurs in both sexes. In the wild, birds usually shed and renew old, worn plumage before the beginning of the cold weather and, in migratory species, also before their migratory flights. Since undomesticated birds lay only a few eggs a year, molting and reproduction are not usually associated with one another (Swanson and Bell, 1974a).

Chickens kept for commercial egg production have a different molting pattern than wild birds. They have been bred for high performance and their thermal and lighting environment is usually controlled to remove major seasonal influences. A natural molt does not normally occur until the end of an extended, intensive period of laying. However, production does not typically extend to this point under commercial conditions, since the quality of the eggshells would become so poor that the eggs would not be saleable.

During a natural molt, a chicken loses feathers from its body in the following order: head; neck; feather tracts of the breast, thighs, and back; wing and tail feathers. In a flock some birds molt more slowly than others; and some molt earlier than others. A high-producing flock characteristically molts late and rapidly.

A natural molt can occur in flocks under certain conditions. For example, minor stresses like temporary food or water shortage, disease, cold temperatures, or changes in the lighting program (decreasing photoperiod), can trigger a molt. Under these circumstances, chickens usually lose some head and neck feathers, but do not molt completely. If the molt continues beyond this point, a severe drop in egg production will occur. Producers structure management programs to try to avoid situations that will cause this type of molt to occur.

**Induced Molting:** With induced molting, a layer flock is induced to shed and replace its feathers at a time selected by the flock manager. This usually comes near the end of a short first laying cycle, or a flock may be molted earlier as part of a multiple molting program.

At present, the only methods commercially available to induce a molt involve a severe nutritional-environmental stress (typically feed removal). Within 5 to 7 days after the stress begins, egg production falls to zero and shortly thereafter feathers begin to drop. Unlike natural molting, which continues for 14 to 16 or more weeks, induced molting stimulates a more rapid shedding of old feathers and return to new plumage. More importantly, the flock uniformly goes out of production and returns to a high rate of lay and improved egg quality.

Induced molting is practiced to give the flock a rest at the end of a period of egg production. The ability of a flock to produce eggs at a high rate after the molt can be attributed to the rest period it receives. A fast of 4 to 5 days will usually cause a flock to cease egg production. Longer fasts of up to 14 days will usually give superior results with regard to subsequent production, but extreme care must be taken to monitor body weight losses and mortality daily during the fast if such programs are to be used.

Molting has welfare advantages for the hen. Feather cover is improved, hence improving the hen's ability to thermoregulate. There is also decreased mortality in molted hens as compared to non-molted hens of the same age. The welfare problems reside with the methods used to induce the molt, namely feed restriction or deprivation, rather than with molting per se.

Extended feed withdrawal causes an increase in mortality during the feed withdrawal period. There is a doubling of mortality during the first week of deprivation as compared to pre-molt levels (.15% prior to feed removal to .30% mortality in the first week after feed removal). Mortality then doubles again (.60%) during the second week of deprivation (Bell, 2000). After this point, there is a reduction in mortality compared to non-molted flocks of the same age (Bell, 2000).

Behavioral evidence suggests that there are higher levels of frustration (Aggrey et al, 1990) and cannibalism (Hy-Line, 1980) in force molted hens. There is an increase in oral behaviors (pecking other than at food) in hens either on restricted feed or deprived of feed (Webster et al, 1995; Savory et al, 1996; Kostal et al., 1992), and some of these oral behaviors appear to be stereotyped. Hembree et al., (1980) suggested that, during the "stress period of the molt", hens expend little energy on social behavior and instead tend to remain standing (Aggrey et al, 1990). Although aggression is reported to be minimal, displacement behaviors (that is, hens pushing other hens so that they are forced to move from the space in which they are standing) are shown to increase.

Overall, behavioral data indicate that hens are frustrated during the "stress" period. This is followed by highly competitive social behavior during the initial part of the recovery period during the molt.

Immunologically, induced molting has a significant impact. The immune system of force molted birds is compromised (see Review for UEP, Stanker, L. 1999) during feed withdrawal. The risk of Salmonella Enteritidis (SE) is increased in fasted birds (Holt, 1993; Holt and Porter, 1992; Holt et al, 1995) and SE spreads throughout the flock more readily (Holt, 1995; Holt et al, 1998). Stanker (1999) concludes that "feed removal to induce molting has the potential to expand a small number of birds infected with SE into a major production problem". Molted birds have been shown to mount an effective humoral response to sheep red blood cells, suggesting that the B cell response is not compromised by feed withdrawal during the molt process (Holt, 1992; Alodan and Mashaly, 1999). However, the suppression of the immune system indicated by a compromised cell-mediated immunity (Holt, 1999), elevated corticosterone levels (Stanker, 1999; Harvey and Klandorf, 1983) an increase in heterophil:lymphocyte ratios, and a reduction in peripheral blood lymphocytes and helper T-cells (Holt, 1992b), shows that the welfare of the hen is compromised, and food safety potentially compromised, as a result of feed withdrawal. Similar physiological changes are seen in birds maintained on severe feed restriction (Zuidhof et al., 1995). Laboratory-based research shows a relation between feed removal and possible health risks; however, field observations linking molting to an increase in SE have not been reported.

*Committee Conclusions*

The committee held many hours of discussion on this topic. As stated previously, the physiological changes induced in the hen as a result of the molt cause a rejuvenation of the hen's ability to produce eggs, improve the hen's feather cover, and decrease mortality as compared to non-molted hens of the same age. On a broader scale, molting results in the use of approximately 50% fewer hens. This in turn results in significantly fewer spent hens that have to be handled, transported, and slaughtered. Moreover, a smaller number of male chicks are produced that must be destroyed because they have no economic value. And finally, the investment for facilities to hatch and raise the additional flocks would be very significant (millions of dollars).

It is the practice of feed withdrawal that has caused animal welfare groups to be concerned about the methods used by the egg layer industry to induce a molt. Our committee agreed with this concern. We recommend that alternatives to feed withdrawal be developed. Cell-mediated immunity is compromised by day 3 of feed withdrawal. The hen's welfare is impacted and there is an increased risk of Salmonella enteritidis. The hen's corticosterone levels are elevated within 48 h and her motivation to eat is significantly increased after only 3 h of deprivation. Displacement behaviors suggestive of frustration are increased within a 4 d fast period. Mortality doubles twice during the first 2 weeks of the fast.

We recommend that the industry avoid attempting to justify this practice as a 'natural anorexia' or mimicking a voluntary decrease in feed consumption. As noted in the literature review, the motivational states of birds undergoing natural molt/voluntary anorexia as compared to those undergoing an induced molt are completely different. Disregarding this fact, and assuming the two states of the birds are similar, evidence supports the fact that total feed withdrawal significantly increases the desire/need to eat. Birds will abandon their eggs to forage for feed. This is evidence of a very strong need to eat.

Although a 4-6 d feed withdrawal period does not produce results comparable to longer feed withdrawal programs in terms of subsequent performance, it is also apparent that there are large variations in the success of the molt program based on the genetic stock, age of the flock, the number of birds per cage, and the lighting regime applied. Furthermore, the necessity of combining a shorter fast with alternate day or limited feeding to accomplish an effective molt virtually eliminates the benefits of the shorter fast from a welfare perspective. Although culling of sick or injured hens prior to initiating a molt is recommended in many molting method guidelines, it is also reported to be difficult to accomplish under practical circumstances and therefore, under current industry conditions weak birds are typically 'naturally culled' during the molting process (Ruszler, 1998) The committee did not find this "natural culling" to be an acceptable welfare practice.

**Molting Recommendations for UEP Guidelines**

1. Producers and researchers are encouraged to work together to develop alternatives to feed withdrawal for molting. These alternatives should include the following:

    a) that the hens are able to consume nutritionally adequate and palatable feed to maintain body weight and zero egg production;
    b) body weight loss should be sufficient so as not to compromise hen welfare during the postmolt period
    c) mortality during the molt should not substantially exceed normal flock mortality.

Until such time that these alternatives are available, the shortest period of feed withdrawal possible should be used to accomplish the goal of rejuvenating the hen's egg production capabilities and overall welfare.

2. Specific recommendations for conducting a molt using feed withdrawal or restriction are as follows:

a) Before recycling any flock, a few birds should be taken to the laboratory to determine if any diseases are present. Diseased flocks should not be molted.
b) Weak or unthrifty birds should be removed from the flock before molting.
c) Flocks should be molted in such a way to minimize mortality and harm to the flock.
d) Mortality and body weight losses must be monitored daily during the molt period.
e) Feed should be returned when body weights reach no less than 70% of the starting weights.
f) Mortality should not exceed 1.2% during the feed withdrawal period.
g) All eggs laid during the first week of the molt should be diverted to breaking.
h) Water must be available at all times.
i) The light should be reduced to 8 hours in closed houses or to natural day length in open houses for the duration of the rest period. When the flock is placed back on a layer diet, lights should be returned to the normal layer program.

# FOOD SAFETY

Food safety first became a major issue of the egg industry when we learned of Salmonella enteritidis (SE) in 1987. In England, a majority of Salmonella infections were being caused by SE, and most all cases were thought to originate from consumption of contaminated eggs. With the news from England, the U.S. began to examine its own SE situation. In 1988 the Centers for Disease Control reported that the sharp increase of SE in the Northeastern states was largely caused by fresh eggs.

Since 1987 a great deal has been learned about SE, primarily because of the research work conducted at the SE Pilot Project. A number of important initiatives have been undertaken by the industry in response to the SE issue, but probably none more important than the establishment of Quality Assurance Food Safety Programs.

Antibiotics and Hormones: No hormones are fed to laying hens to enhance performance or induce growth. However, antibiotics are used occasionally when needed to fight infections.

Induced molting is a management practice used by a majority of egg production farms in the U.S. for reasons of improved egg quality as well as adding to the productive life-span of the laying hen. This management practice has been challenged by some people contending that this poses a food safety risk.

There is a limited amount of research that indicates an increased prevalence of SE in molted flocks. Insufficient research has been conducted to develop a conclusive decision on the impact that molting may contribute to food safety risks. Until such time that scientific research has provided the needed answers, the following recommendations are made:

**Food Safety Recommendations for UEP Guidelines**

1. All egg producers and processors should implement the UEP 5-Star Total Quality Assurance Food Safety Program or one of the many excellent state programs.
2. All eggs produced during the molt period should be diverted to pasteurization or hard cooking starting with the first day that a molt is induced.
3. An SE vaccine should be administered once egg production reaches zero and birds are returned to full feed during the molt period. Manufacturer's recommendations should be followed for administering vaccines.

# HUMANE HANDLING, TRANSPORTATION AND SLAUGHTER OF SPENT HENS

***Background***

Leghorn-type hens tend to have relatively weak bones by the end of lay. As a result, there is a high risk of bone fractures occurring when they are handled prior to slaughter (Gregory & Wilkins, 1989,1992).

Spent hens have a low economic value and, thus, there has been little incentive for investment in genetic selection for increased bone strength, although this may be possible (Mandour et al., 1989). Nor has there been much economic incentive to develop and adopt equipment, feeding programs, and handling and management techniques that help to prevent bone breakage and other injuries during pre-slaughter handling.

Because of their low economic value, spent hens may have to be transported long distances to reach the nearest processing facility equipped to take such hens. They may also be fasted for prolonged periods prior to shipping and exposed to adverse environmental conditions during transport. Consequently, rates of antemortem and postmortem condemnation of spent hens are relatively high. If a processing facility or other market is not available, spent hens may have to be killed on-farm. All of these situations raise welfare concerns.

***Literature Review***

Hens' bones become weak when structural bone is broken down to obtain calcium for eggshell formation. It is important that all hens are able to consume sufficient calcium and phosphorus everyday to support eggshell formation without loss of structural bone (Cheng & Coon, 1990; Roland & Rao, 1992; Whitehead & Wilson, 1992). There is some evidence that currently recommended dietary levels of calcium and phosphorus (National Research Council, 1994) may not be sufficient to maximize the bone strength of laying hens (Cheng & Coon, 1990; Roland & Rao (1992).

Bone loss is reduced when bones are loaded through exercise (Meyer & Sunde, 1974; Lanyon, 1992). Providing adult hens with more horizontal and vertical cage space during lay allows more movement of all body parts, thereby helping to maintain the strength of all bones (Harner & Wilson, 1985; Tauson & Abrahamsson, 1994). However, rearing pullets in floor pens instead of cages does not improve their subsequent bone strength when housed in cages as adults (Gregory et al., 1991; Whitehead & Wilson, 1992; Anderson & Adams, 1994).

Catching appears to be the primary source of injury prior to arrival at the slaughter plant. Wing flapping, bodily impact against hard surfaces both inside and outside the cage and struggling in the hands of the catcher create opportunities for bruising, joint dislocation and bone breakage (Gregory et al., 1994). Careful handling can substantially reduce the rate of injury during catching (Gregory & Wilkins, 1989). Also, the fewer times that hens are handled and transferred between handlers, the lower the risk of injury.

Catchers typically grasp a single leg to remove a hen from a cage. Gregory et al. (1993) reported that 4.6% of hens had broken bones when removed individually from their cages by two legs whereas the incidence of bone breakage was 10.8% when hens were removed in groups of 2-3 by one leg, and 13.8% when removed individually by one leg.

Fewer injuries occur when hens are caught individually and placed directly from their cage into a transport container rather than being carried manually from the house in groups and placed simultaneously into a transport container (Alvey et al., 1992; van Niekerk & Reuvekamp, 1994). Stress is minimized when birds are handled in an upright posture (Knowles & Broom, 1990; Jones, 1992; Kannan & Mench, 1996).

Light intensity has a major effect on poultry behavior during catching. Gregory et al. (1993) kept hens at light intensities of 15,2 or 0.5 lux during lay and caught them at intensities of 12, 2 or 0.5 lux (for footcandles, divide by 10). The hens kept and caught at the highest light intensities were the most difficult to catch and the hens kept and caught at 0.5 lux were the easiest to catch. Also, hens in the top tier of cages were more alarmed and difficult to catch than hens in lower tiers. However, at 0.5 lux, hens showed no signs of alarm as the catcher approached their cage.

Fasting for more than 24 hours prior to slaughter results in bone loss, an increased risk of bone breakage during catching (Savage, 1991) and reduced ability to withstand the rigors of transportation. These factors can lead to high rates of antemortem and postmortem condemnation. Other factors that can elevate the condemnation rate include prolonged time in transit and exposure to excessive heat or cold during transit (Mitchell et al., 1997; Weeks & Webster, 1997; Mitchell & Kettlewell, 1998). When the transport vehicle is stopped, the temperature in the load increases rapidly within one hour. High humidity combines with high temperature to impair the ability of birds to lose excess heat.

Modified atmosphere killing (MAK) carts have been developed for the slaughter of spent hens on the farm (Webster et al., 1996). These carts use carbon dioxide to render hens unconscious. At least 30 seconds must pass after hens are placed inside a MAK cart before more hens are added. Because air enters the cart with each hen, the operator must monitor the hens and add carbon dioxide frequently to ensure that the concentration of carbon dioxide remains high enough to initiate and maintain unconsciousness (Newberry et al., 1999). Cervical dislocation is considered to be an acceptable method for euthanasia of small numbers of hens when performed by skilled workers (Andrews et al., 1993; Guide for the Care & Use of Agricultural Animals in Agricultural Research & Teaching, 1999).

***Committee Conclusions***

There is a general public expectation for responsible stewardship of food-producing animals, and transport and slaughter are areas of particular public concern. Handling, transport, and on-farm euthanasia of spent hens can be improved by using appropriate equipment and management and having properly trained personnel.

Use of pullet carts appears to be the best option currently available for flock removal. When the carts are rolled directly in front of the cages, hens can be transferred individually from their cage into a cart within a few seconds. When full, the carts can be rolled directly onto a transport trailer without further handling of the hens.

When hens must be euthanized on the farm, cervical dislocation is an accepted method when performed by skilled workers. MAK carts, when properly operated, appear to be the best currently available option for the slaughter of larger numbers of hens. This is because hens can be transferred directly from their cage into a cart with a minimum of handling and fall unconscious within seconds of leaving their cage.

## Humane Handling, Transportation & Slaughter
## Recommendations for UEP Guidelines

1. Provide caged layers with as much space as possible, both horizontal and vertical, to facilitate movement and, thus, help to maintain bone strength during lay.
2. Feed appropriate diets and provide adequate feeder space to ensure that all hens in lay are able to consume sufficient calcium and phosphorus everyday to support eggshell formation without loss of structural bone.
3. Remove hens from the cage one hen at a time by grasping both legs, rather than a single leg, and support the hen's breast as she is lifted over the feed trough. Handle hens in an upright posture and avoid inverting them as much as possible.
4. To reduce escape behavior, lower the light intensity when catching and removing hens from the layer house. Use the lowest light level possible without impinging on worker safety.
5. Minimize the amount of handling by using pullet carts for flock removal from the house and transport to the processing plant. Consider the design of the house to ensure that the doorways, loading ramps, and alleys in front of all cages will accommodate the safe use of pullet carts. The use of hanging carts is not recommended.
6. The injury rates resulting from different conveyor and pneumatic systems need to be evaluated before these systems are implemented commercially.
7. All members of a catching crew should be knowledgeable and skillful in handling hens with care. Training of catchers could substantially reduce the risk of bone breakage and other injuries. Escape and dropping of hens must be minimized.
8. The size of cage doors, crate doors and panels on trucks should be large enough to permit easy passage of hens to avoid bone breakage and other injuries.
9. Hens should be loaded only into clean, well-maintained transport containers and vehicles. Hens should be loaded into each transport container at a density appropriate for the weather conditions. The doors of transport containers must be closed securely so that hens do not fall out in transit.
10. To help reduce the risk of bone breakage and health problems resulting in condemnation, in coordination with the processing plant, avoid fasting any hen for more than 24 hours prior to slaughter. Water withdrawal prior to removal of hens from the layer house is not recommended.
11. Coordination is needed between producers, catchers, truckers and processors to minimize the time between catching and slaughter and to avoid exposure of hens to excessive heat or cold during this period.
12. Training is needed to ensure that on-farm euthanasia is performed humanely. Cervical dislocation is an acceptable method for euthanizing small numbers of hens. MAK carts can be used for the slaughter of larger numbers of hens. New technologies for on-farm euthanasia need to be evaluated for humaneness before they are implemented commercially.